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INSTRUCTION MANUAL

KEPCO®

131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 U.S.A.
(212) 461-7000 • TWX #710-582-2631

KEPCO

SWITCH-MODE POWER SUPPLIES

RMK

Model RMK 24-S

FSC CAL LAB
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DATE

Serial No. T.63210.

instruction manual

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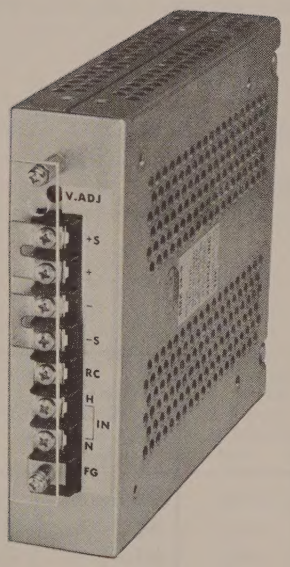


FIG. 1-1 KEPCO RMK–S SWITCH MODE POWER SUPPLY MODULE.

SECTION I – INTRODUCTION

1-1 SCOPE OF MANUAL

1-2 This manual contains instructions for the installation, operation and maintenance of the KEPCO RMK–S series of switch-mode stabilized power supply modules.

1-3 GENERAL DESCRIPTION

1-4 The Kepco series RMK–S power supplies are general purpose, highly efficient, voltage stabilized d-c sources with adjustable output current limit and overvoltage protection. RMK–S power supplies are low-dissipative stabilizers using switching devices to control the output power.

1-5 RMK–S power supplies are manufactured with output power ratings as given in Table 1-3.

1-6 The RMK–S power supply is constructed in a compact aluminum case (see FIG. 1-2 "Mechanical Outline Dwg." for dimensions and finish). Single board construction provides ready access to all components after cover removal.

1-7 SPECIFICATIONS, ELECTRICAL

A) A-C SOURCE INPUT: 100 to 130V a-c, 47 to 440 Hz, single phase.
B) D-C SOURCE INPUT: 130 to 170V.
C) D-C OUTPUT VOLTAGE: See Table 1-1. D-C OUTPUT CURRENT: See Table 1-3.
Note: RMK models will operate down to 90V a-c (or 105V d-c) with minor performance degradation.

GROUP	MODEL	D-C OUTPUT VOLTS	SHIP. WGT. lbs.	SHIP. WGT. kg.	SOURCE EFFECT FOR 100-130V A-C or 130-170V D-C INPUT SOURCE CHANGE typ.	SOURCE EFFECT FOR 100-130V A-C or 130-170V D-C INPUT SOURCE CHANGE max.	LOAD EFFECT FOR 10 to 100% LOAD CURRENT CHANGE typ.	LOAD EFFECT FOR 10 to 100% LOAD CURRENT CHANGE max.	A-C INPUT CURRENT (1) @115V A-C @25 °C
	RMK 05–S	3.5–5.5	1.4	0.65	0.4%	0.8%	0.4%	1%	
	RMK 09–S	6.5–10.0	1.4	0.65	0.4%	0.8%	0.4%	1%	
EFFICIENCY:	RMK 12–S	8.5–13.5	1.4	0.65	0.4%	0.8%	0.4%	1%	0.9 A rms
67% min.	RMK 15–S	10.5–16.5	1.4	0.65	0.4%	0.8%	0.4%	1%	max.
73% typ.	RMK 24–S	17–26.5	1.4	0.65	0.4%	0.8%	0.4%	1%	

TABLE 1-1 D-C OUTPUT AND A-C INPUT SPECIFICATIONS, RMK–S POWER SUPPLY SERIES.

(1) RMK power supplies, operated from a d-c source as specified in PAR. 1-7B, require d-c input currents approximately equal to the listed output power, divided by their efficiency, times d-c input voltage: I_{in} (d-c) = P (Watts) ÷ (Eff. x V_{in}).

1-7 SPECIFICATION, ELECTRICAL (Cont'd.)

D) D-C STABILIZATION: See Table 1-1.

E) OTHER OUTPUT EFFECTS: See Table 1-2.

TEMPERATURE EFFECT		
Coefficient per °C	< 0.02%	0.1%
Envelope, 0–50°C:	< 0.6%	1.0%
COMBINED EFFECT: (For rated changes in source voltage, load current and temperature:	< 1%	2%
TIME EFFECT (8-hour drift) Constant source voltage, load and temperature:	< 00.2%	0.1%
RIPPLE and NOISE		
Rms:	< 7 mV	10 mV
Source component:	< 20 mV	50 mV
Switching component:	< 30 mV	100 mV
Spike voltage to 10 MHz:	< 70 mV	100 mV

TABLE 1-2 OUTPUT EFFECTS, RMK–S SERIES.

CAUTION

THE OUTPUT CURRENT LIMIT CONTROL (O.C.) ON EACH RMK MODEL IS SET TO APPROXIMATELY 115% OF THE 50°C RATING. IT MAY BE RESET TO THE HIGHER OUTPUT CURRENT VALUES, AS LISTED IN THE 40°C AND 30°C OLUMNS OF TABLE 1-3, BY FOLLOWING THE PROCEDURE GIVEN IN SECTION III OF THIS MANUAL.

MODEL	VOLTS	AMPS @ 30°C	AMPS @ 40°C	AMPS @ 50°C	AMPS @ 60°C	AMPS @ 71°C
RMK 05–S	5V	6.9A	6.4A	6.0A	4.2A	2.4A
RMK 09–S	9V	4.1A	3.7A	3.3A	2.3A	1.3A
RMK 12–S	12V	3.0A	2.7A	2.5A	1.7A	1.0A
RMK 15–S	15V	2.4A	2.2A	2.0A	1.4A	0.8A
RMK 24–S	24V	1.6A	1.4A	1.3A	0.9A	0.5A

TABLE 1-3 RMK OUTPUT CURRENT RATINGS AT VARIOUS AMBIENT TEMPERATURES.

NOTE: Output current values for intermediate temperature values can be linearly interpolated.

1-7 SPECIFICATIONS, ELECTRICAL (Cont'd.)

F) STORAGE TEMPERATURE: (-)50°C to (+)85°C.

G) TRANSIENT RECOVERY: A step-load change of 50 to 100% produces less than 2% or 0.5 Volts, whichever is greater, output voltage excusion and recovers to within 0.5% (or 0.05 volts, whichever is greater) of the original output voltage setting in less than 2 milliseconds.

H) HOLDING TIME (CARRY-OVER): Full load output is sustained within the load effect band for a minimum of 20 milliseconds, following loss of a-c input source power. Note: Specification is based on operation of 115V a-c source voltage and the 50°C loading level per Table 1-3.

1-8 MISCELLANEOUS FEATURES:

A) SOFT START: Soft-start circuit provided on all models, to limit a-c line surge current at the initial turn-on.

B) REMOTE ON/OFF CONTROL: Following initial source turn-on, all RMK models may be turned on and off by means of a TTL logic level (turn-on = high, turn-off = low. The logic level is normally set high (RMK "on") by means of a pull-up resistor). Separate rear terminals are provided for this function.

C) PROTECTIVE FEATURES:

1) A-C INPUT PROTECTION: A-C line fuse located on the P.C. board of all RMK—S models (see Parts List).

2) DRIVER INHIBIT: Turns off driver circuit when source input fails.

3) OVERVOLTAGE PROTECTION: Turns off oscillator circuit and reduces power supply output to zero. Reset by turning source power "off" (for approx. 5—10 seconds to allow input filter to discharge) and then "on" again. Trigger voltage approx. 120% above nominal output voltage.

4) CURRENT LIMIT: Screwdriver adjustable to 115% of the values listed @ 30°C and @ 40°C in Table 1-3 for each model. Factory set to 115% of the 50°C current value.

D) OUTPUT VOLTAGE ADJUSTMENT: Output voltage screwdriver adjustable +10% -30% around the nominal rated value (see Table 1-1).

E) ELECTROMAGNETIC INTEREFERENCE (E.M.I.): Filters are built-in to reduce the conducted EMI (harmonics of the 25 KHz switching frequency) to levels that are acceptable for most applications. An accessory filter, Kepco Model FLT-3A may be used between RMK and the source power line to reduce the harmonics at least 60dB in the range from 0.15 to 20MHz.

F) SHOCK and VIBRATION: Withstands normal transportation and handling without damage.

G) ISOLATION, between input and output terminals or case: 1.5kV a-c for 1 minute. (Tested @ 25°C and 60% R.H.).

H) ISOLATION, between output terminals and case: 500V d-c, 10 megohms minimum. (Tested @ 25°C and 60% R.H.).

I) SERIES/PARALLEL: RMK power supplies may be connected in series for greater voltage output (up to 500V maximum) and in parallel, for increased current output (see Section III).

1-9 MECHANICAL SPECIFICATIONS:

Refer to FIG. 1-2 "Mechanical Outline Drawing".

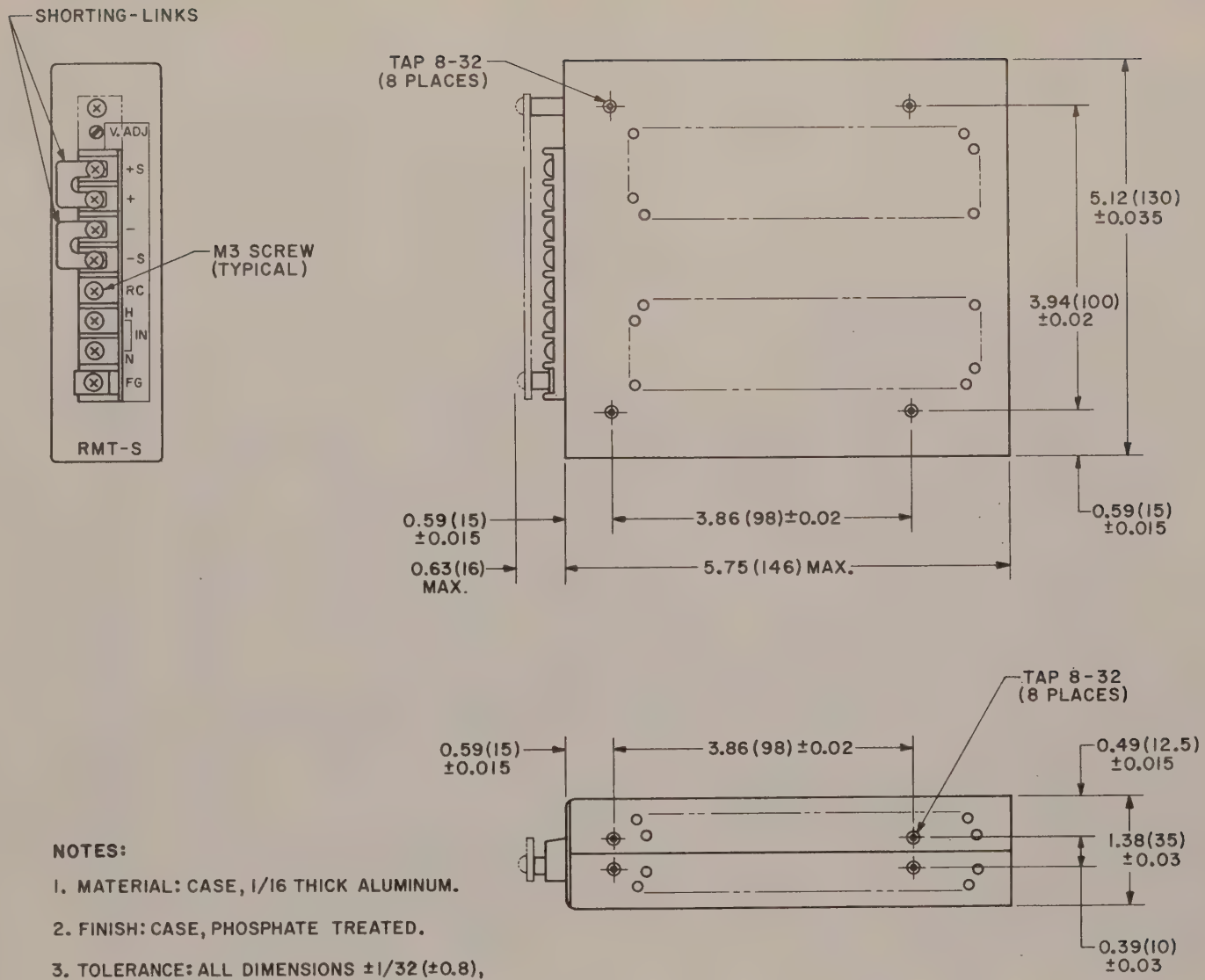


FIG. 1-2 MECHANICAL OUTLINE DRAWING, RMK-S SERIES

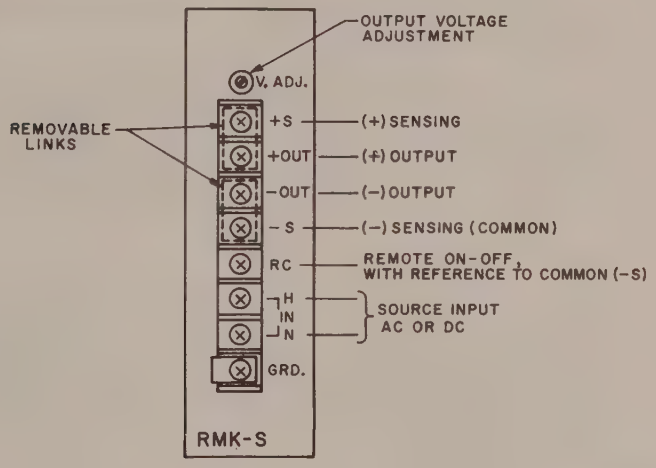
NOTES:

1. MATERIAL: CASE, 1/16 THICK ALUMINUM.
2. FINISH: CASE, PHOSPHATE TREATED.
3. TOLERANCE: ALL DIMENSIONS ±1/32 (±0.8), EXCEPT AS NOTED.
4. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS.

SECTION II – INSTALLATION

2-1 UNPACKING AND INSPECTION

2-2 This instrument has been thoroughly inspected and tested prior to packing and is ready for operation. Perform a physical inspection and the preliminary operational check as outlined in paragraph 2-8. If any indication of physical damage is found, file an immediate claim with the responsible transport service.



NOTE: ON ALL RMK UNITS, D-C INPUT VOLTAGE MAY BE APPLIED TO SOURCE INPUT TERMINALS WITHOUT REGARD TO POLARITY.

FIG. 2-1 TERMINATIONS, KEPCO RMK–S POWER SUPPLIES.

2-4 SOURCE POWER REQUIREMENTS

1) A-C INPUT VOLTAGE: 115V ±15V a-c. D-C INPUT VOLTAGE: 130 to 170V

2) A-C INPUT FREQUENCY: 47 to 440 Hz, single phase.

3) A-C INPUT CURRENT: 0.9A max. (rms).

2-5 SOURCE POWER TURN-ON/TURN-OFF

2-6 Source input power to the RMK power supply is applied in the conventional manner by means of an external power switch in series with one or both of the source input terminals, (see FIG. 2-2).

2-7 Following source turn-on, for systems applications the RMK power supply can be remotely programmed "on" and "off" by means of a contact closure, or TTL logic levels. This permits turn-on/off sequencing and avoids a-c surge currents associated with conventional a-c power turn-on/off cycles. In FIG. 2-2, both the conventional and the remote a-c power turn-on/off methods are shown:

A) If remote turn-on/off is not needed, delete components connected to terminals RC, -S and leave these terminals open.

B) If the remote control method is used, retain the SOURCE POWER switch. NOTE: Source power turn-on/turn-off must be retained since the overvoltage protector circuit is re-activated, following an overvoltage condition, by removing (5 seconds minimum) and re-applying the power. Either the indicated switch (S1) or TTL levels may be used for remote control as indicated in the table of FIG. 2-2. The switch (S1) must be "chatter-free", ***or*** the indicated components should be used to integrate the switching pulse.

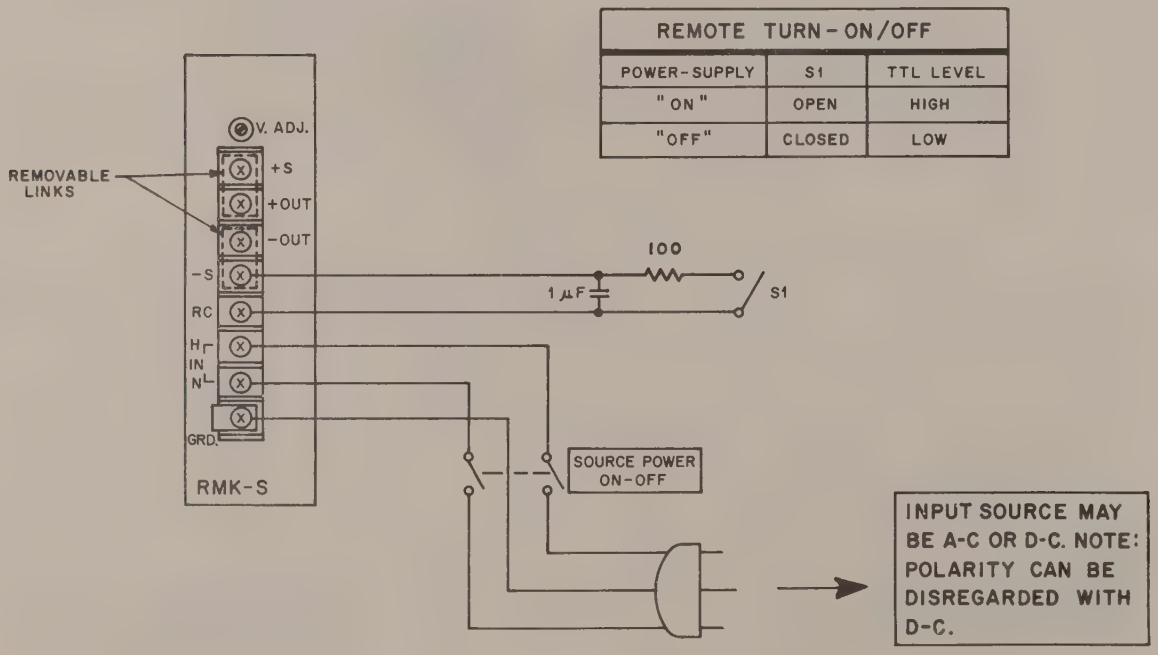


FIG. 2-2 CONVENTIONAL AND REMOTE SOURCE POWER TURN-ON/TURN-OFF.

Note: Remote turn-on/off circuit may be deleted.

2-8 PRELIMINARY CHECK-OUT

2-9 A simple operating check after unpacking and before permanent installation is advisable to ascertain whether the power supply has suffered damage resulting from shipment. Refer to FIG. 2-3 for the location of the output terminals. Connect output metering and load as shown.

a) Connect power supply to 115V a-c source Use either turn-on/turn-off method as described in PAR. 2-5 through 2-7.

b) Turn the RMK power supply "on", and observe the output voltage meters (M1, M2) for the rated nominal output voltage and current of the RMK model under test.

c) Check the current limit point by ***reducing*** the load resistance until the output voltage starts to decrease, as observed on M1. The output current value, as observed on M2, should be approximately 115% of the rated nominal output current value for the RMK power supply under test. This concludes the preliminary check-out.

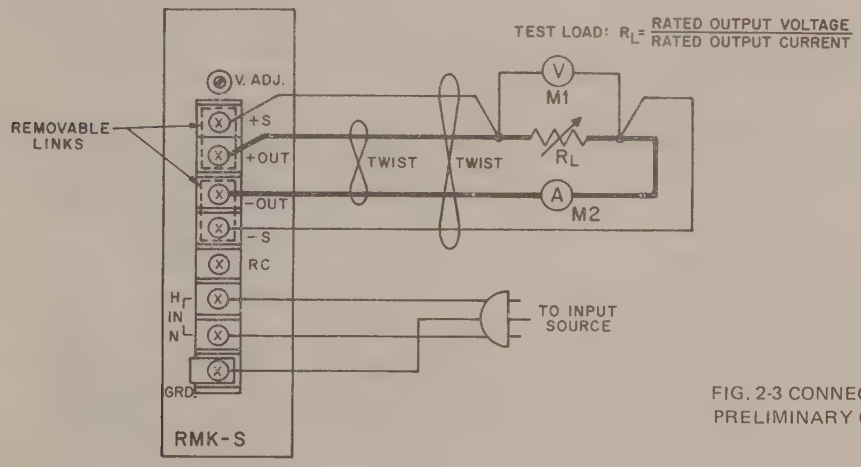


FIG. 2-3 CONNECTIONS FOR THE PRELIMINARY CHECK-OUT.

2-10 INSTALLATION AND COOLING REQUIREMENTS

2-11 GENERAL. RMK power supplies may be operated in ambient temperatures from 0 to 71°C, without forced air cooling and with the output currents as listed in Section I, Table 1-3, when mounted as described in the following paragraphs.

CAUTION

ALL RMK POWER SUPPLY OUTPUT CURRENT RATINGS ARE BOUND BY A MAXIMUM AVERAGE HEAT SINK TEMPERATURE OF 80°C AND BY THE MAXIMUM OUTPUT CURRENT OF EACH MODEL, AS LISTED IN THE 30°C COLUMN OF TABLE 1-3, SECTION I.

IF A RELIABLE MEANS OF DETERMINING THE HEAT SINK TEMPERATURE IS AVAILABLE, RMK POWER SUPPLIES MAY BE MOUNTED IN ANY POSITION AND MAY BE OPERATED AT THEIR MAXIMUM CURRENT (AS LISTED IN THE 30° COLUMN OF TABLE 1-3, SECTION I) AS LONG AS THE MEASURED AVERAGE HEAT SINK TEMPERATURE DOES NOT EXCEED 80°C. IF NECESSARY, FORCED AIR FLOW CAN BE PROVIDED TO KEEP THE HEAT SINK TEMPERATURE AT OR BELOW 80°C. FOR ADDITIONAL PROTECTION, A THERMALLY ACTUATED SWITCH CAN BE MOUNTED ONTO THE HEAT SINK, WITH ITS "NORMALLY OPEN" CONTACTS WIRED ACROSS THE POWER SUPPLY'S "RC" TERMINALS. IN THE EVENT OF AN OVER-TEMPERATURE CONDITION, THE "RC" TERMINALS WILL BE SHORTED AND THEREBY INHIBIT ALL OUTPUT FROM THE RMK POWER SUPPLY, AS LONG AS THE OVER-TEMPERATURE CONDITION PERSISTS.

2-12 MOUNTING WITHOUT FORCED AIR COOLING, GROUP RMK—S. RMK—S models may be mounted in the two positions shown in FIG's 2-4 and 2-5 respectively. If installed with the optional heat sink as illustrated, output current ratings, as specified in Section I, Table 1-3, may be increased 15% above the values given.

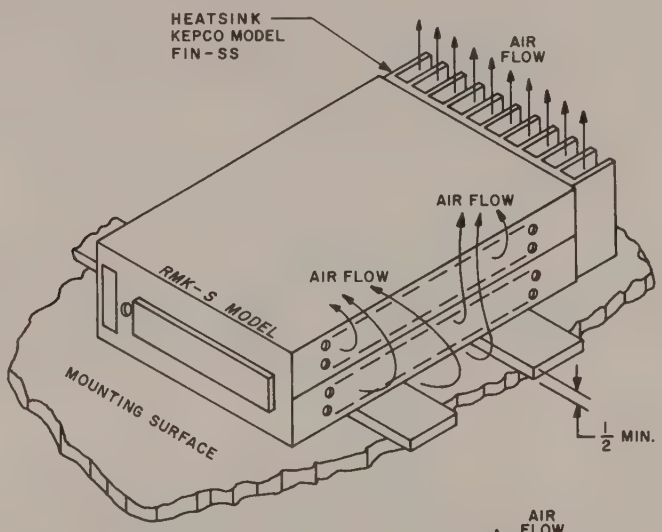


FIG. 2-4 RECOMMENDED MOUNTING METHOD (HORIZONTAL) FOR RMK—S POWER SUPPLIES

Determine ambient temperature, use Table 1-3 in Section I and add 15% to the table values.

Output current rating *without heat sink*: Determine ambient temperature, and use Table 1-3 in Section I.

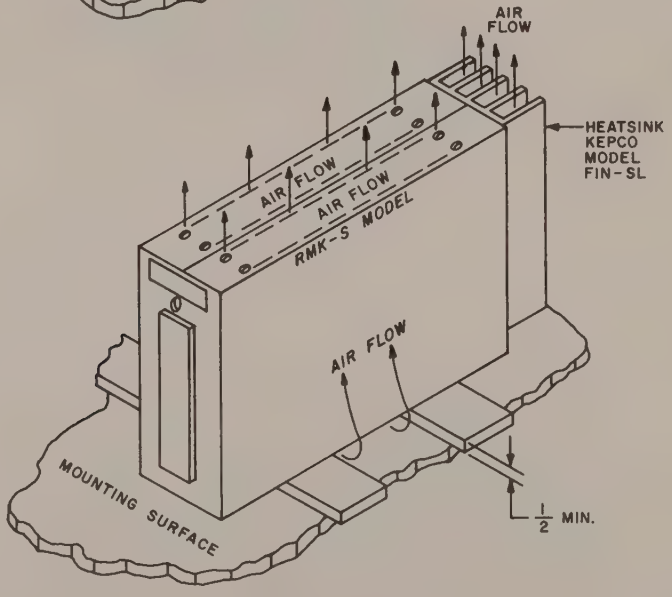


FIG. 2-5 RECOMMENDED MOUNTING METHOD (VERTICAL) FOR RMK—S POWER SUPPLIES

Output current rating with *heat sink:* Determine ambient temperautre, use Table 1-3 in Section I and add 15% to the table values.

Output current rating *without heat sink:* Determine ambient temperature and use Table 1-3 in Section I.

SECTION III – OPERATION

3-1 GENERAL

3-2 Interconnection between an a-c power source and a stabilized power supply, and between the power supply and its load are as critical as the interface between any other electronic equipment. If optimum performance is expected, certain rules for the interconnection of source, power supply and load must be observed by the user. These rules are described in detail in the following paragraphs.

3-3 SAFETY GROUNDING

3-4 National and international safety rules dictate the grounding of the metal cover and case of any instrument connected to the a-c power source.

WARNING

KEEP INSTRUMENT GROUNDED WHILE IT IS CONNECTED TO THE A-C POWER SOURCE

3-5 The recommended a-c power connections to RMK power supplies by means of a three-wire a-c line cord with grounding plug are illustrated in all diagrams in this section (Section III).

3-6 SIGNAL GROUNDING

3-7 Connections between the power supply and the load (load and sensing connections), will invariably, despite all precautions such as shielding, twisting of wire-pairs, etc., "pick-up" radiated noise of a wide frequency spectrum. To minimize this undesired output, a SIGNAL GROUND is needed. The signal ground consists of a single ground point, either at one of the power supply output terminals or at one side of the load.

3-8 Kepco has provided an internal signal ground on all models in the RMK series, consisting of a capacitor from both d-c output terminals to the chassis. If, therefore, the chassis of the RMK is a-c safety grounded by means of its three-prong plug, the safety, as well as the signal ground is automatically established.

3-9 The signal ground provided internally in the RMK is sufficient for performance within specifications for most applications with an isolated load. If the load has its own ground, however, or high ripple is observed during operation, an additional filter capacitor may be required directly across the load terminals.

3-10 POWER SUPPLY/LOAD INTERFACE

3-11 The general function of a voltage or current stabilized power supply is to deliver the rated output quantities to the connected load. The load (or loads) may have any conceivable characteristic. It may be fixed or variable, it may have predominantly resistive, capacitive, or inductive parameters, and it may be located very close to the power supply, or it may be a considerable distance away. The power supply designer cannot anticipate every conceivable application, location or nature of the load. He must design his product for the widest possible application range and specify the performance at the output terminals of the power supply. The aim of the following paragraphs is to aid the user in the final use of the product, the interface of the power supply and the load.

3-12 The perfect interface between a power source and its load would mean that the specified performance at the output terminals would be transferred without impairment to any load, regardless of its characteristics, distance from the power supply or environment. To approach this ideal, the power supply must satisfy certain requirements. Interconnecting rules must be closely followed and Ohm's Law, as well as basic a-c theory must be considered in selecting the interface wiring.

3-13 The stabilized d-c power supply is definitely not an ideal voltage or current source with zero output impedance (VOLTAGE MODE) at all frequencies. All voltage sources have some amount of impedance which increases with frequency. (Refer to FIG. 3-1.) A more realistic model for a voltage stabilized power supply must, for example, include a series resistance, representing the small d-c and low frequency source impedance, in series with an inductance, representing the source impedance at higher frequencies.

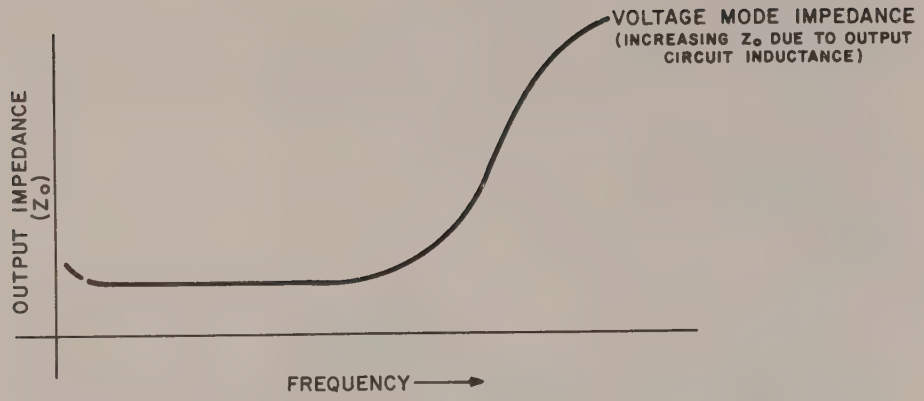


FIG. 3-1 TYPICAL OUTPUT IMPEDANCE VS. FREQUENCY PLOT FOR STABILIZED D-C VOLTAGE SOURCES.

3-14 LOAD WIRE SELECTION

3-15 Load wire selection should proceed considering the facts discussed in PAR's 3-10 to 3-14. The load wire size should be selected for minimum voltage drop, and the series inductance of the load wire must be kept as small as possible compared to the output impedance of the power supply. These considerations are especially important if:

1) The load is constantly changing in value.

2) The load is switched "on" and "off".

3) The load has a primarily reactive characteristic.

4) The dynamic output response of the power supply is considered important.

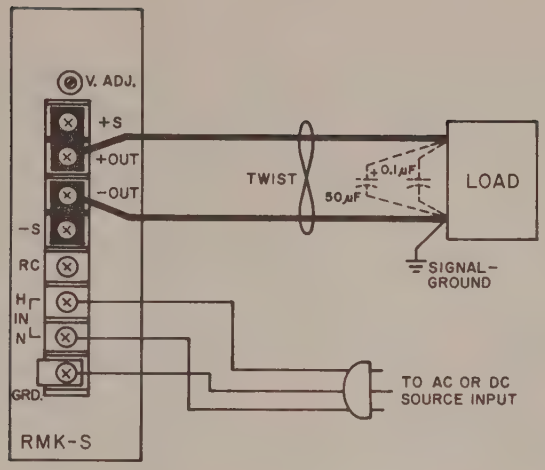
IN PRACTICAL TERMS, THE LOAD WIRE SHOULD ALWAYS BE AS HEAVY AND AS SHORT AS POSSIBLE.

In spite of all precautions taken in interconnecting the power supply and the load, and in spite of the low ESR electrolytics and high frequency bypass capacitors used in the output of the RMK power supply, the power supply/load connection wires will "pick-up" high frequency switching noise.

An effective solution to the pick-up problem is to locate an external shunt filter directly at the load, as indicated in all connection diagrams in this section. The filter consists of a low/high frequency bypass capacitor (C1 = 50μF electrolytic, C2 = 0.1μF, high frequency type, working voltages according to power supply output voltage). The given values have been used successfully for most applications.

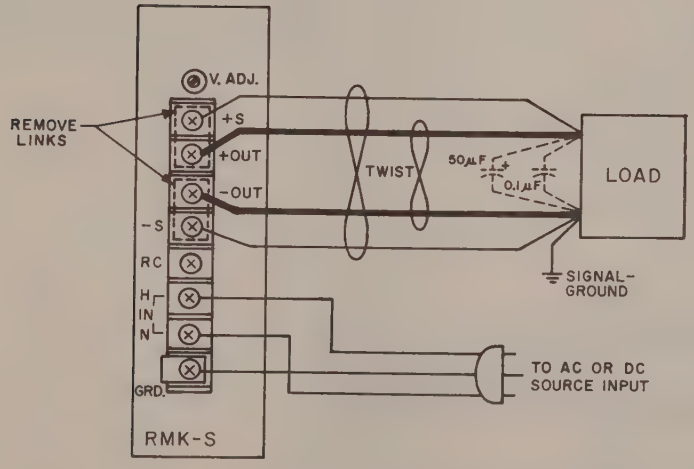
3-16 LOAD CONNECTIONS

3-17 The load may be connected in one of the ways illustrated in FIG's 3-2 or 3-3. IMPORTANT NOTE: IF ERROR SENSING IS USED, THE SHORTING LINKS BETWEEN OUTPUT AND SENSING TERMINALS MUST BE COMPLETELY REMOVED. IF ERROR SENSING IS NOT USED, THE LINKS MUST BE CONNECTED AT THE BARRIER STRIP. TIGHTEN BARRIER STRIP TERMINAL SCREWS SECURELY. LOOSE CONNECTIONS MAY CAUSE MALFUNCTIONING OF THE POWER SUPPLY.



NOTE: An additional filter may be required at the load as shown. See PAR.'s 3-14, 3-15.

FIG. 3-2 LOAD CONNECTIONS *WITHOUT* ERROR SENSING, RMK GROUP S.



NOTE: An additional filter may be required at the load as shown. See PAR.'s 3-14, 3-15.

FIG. 3-3 LOAD CONNECTIONS *WITH* ERROR SENSING, RMK GROUP S.

3-18 SERIES OPERATION OF RMK POWER SUPPLIES

3-19 KEPCO RMK power supplies can be series-connected for increased output voltage, provided the specified limits on voltage to chassis are not exceeded.

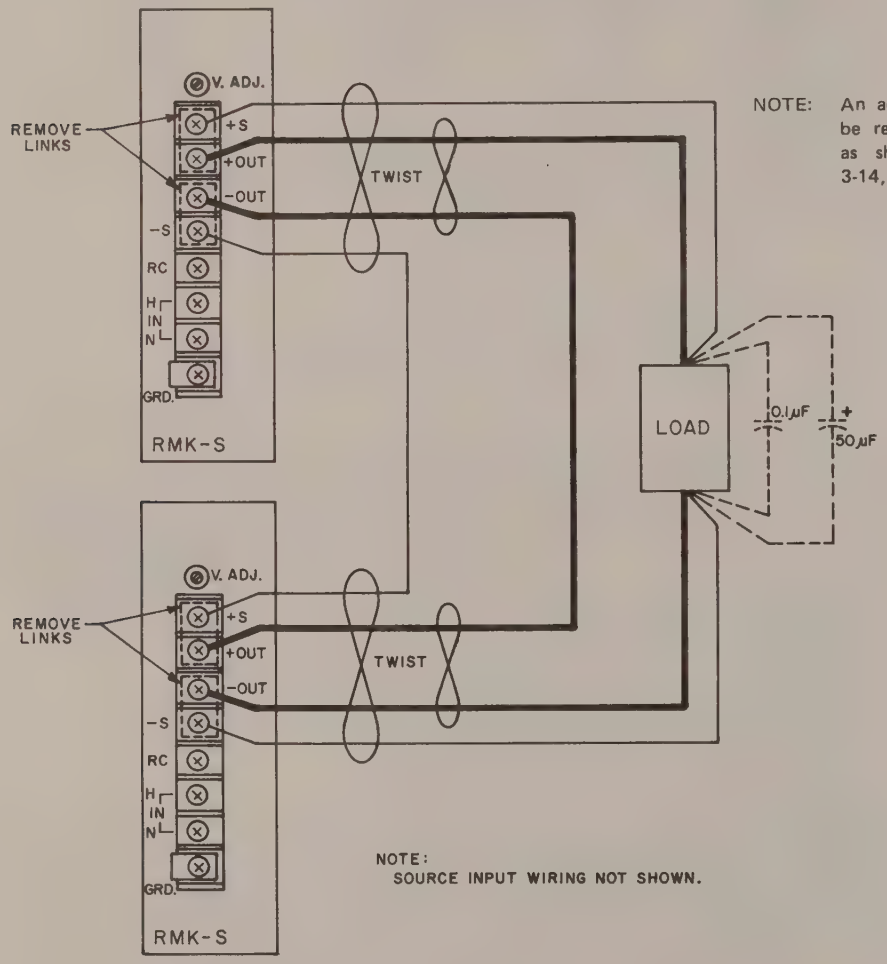


FIG. 3-4 SERIES CONNECTION OF RMK POWER SUPPLIES, WITH ERROR SENSING AT THE COMMON LOAD.

3-20 PROCEDURE (Refer to FIG. 3-4):

a) Connect supplies and load as shown in FIG. 3-4. Keep voltage drop in load wires as low as possible by using proper gauge-wire.

b) Remove jumpers as shown and connect error sensing leads to load. Use at least #20 gauge wire for error sensing leads. Twist all lead pairs.

c) Turn supplies "on" and adjust output on either one or both voltage controls as required.

3-21 PARALLEL OPERATION OF RMK POWER SUPPLIES

3-22 When two RMK power supplies operate into a load demanding more output current than one of them can deliver, one of them will always be at a slightly higher output voltage level than the other, in spite of any attempt to equalize the output voltages before connecting the load. The supply with the higher output voltage (Supply #1) will therefore attempt to deliver all the output current, but will only be able to supply current up to its current limit setting and will then transfer into the current limit mode. The other supply (Supply #2) will now take over and deliver the balance of the output current, while operating in the "voltage mode."

3-27 PROCEDURE, PARALLEL CONNECTION OF TWO RMK 05—S POWER SUPPLIES

Set operating control on ***each*** RMK as follows:

1) V.ADJ. control: 5.1 Volt.
2) O.C. control: Leave at factory setting (A = 115% of rated current at 50°C).

STEP 1) Connect RMK power supplies, instrumentation and load, as shown in FIG. 3-5.

STEP 2) Turn power supply system "on" and monitor load voltage and current as indicated in FIG. 3-5.

STEP 3) With a suitable screwdriver, slowly turn V.ADJ. control of Supply #1 counterclockwise until 5.00 volts is read out on M1.

STEP 4) Turn V.ADJ. of Supply #2 slowly counterclockwise until it takes control from Supply #1 as indicated by the changing voltmeter reading on M1. Turn V.ADJ. to approximately 4.90 volts and then slowly approach 5.00 volts until Supply #2 just reaches 5.00 volts. This concludes the adjustment.

Note: Careful adjustment of the output voltage of the two supplies will result in equal current sharing and yield load effects close to that of a single unit. A carefully adjusted system should yield output voltage changes fo full load to no load of approximately 60 mV.

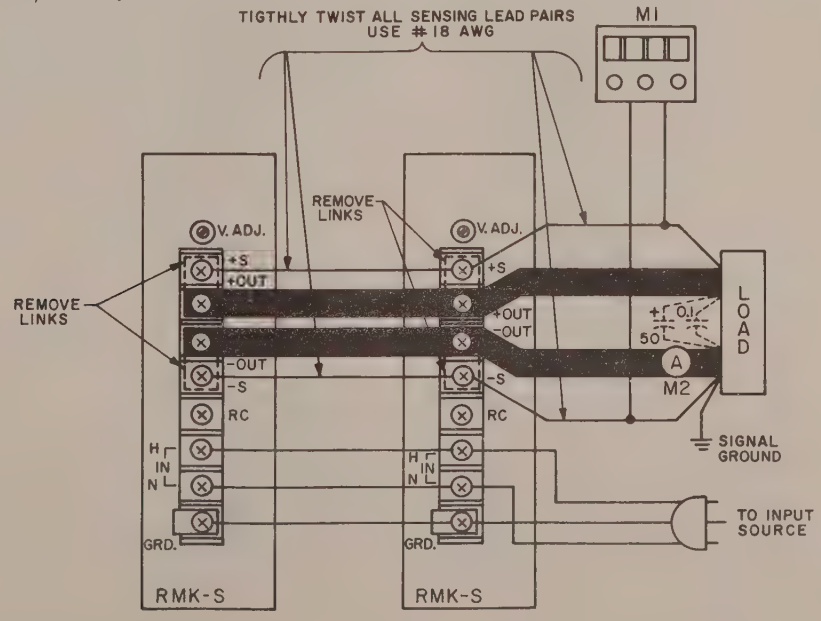


FIG. 3-5 PARALLEL CONNECTION OF TWO RMK POWER SUPPLIES.

3-24 INTERNAL ADJUSTMENTS AND CALIBRATIONS

3-25 The standard factory-set values for all internal controls are listed in Section I, Table 1-3. Re-adjustment of these controls to other than the listed values is described in the following paragraphs.

CAUTION

RE-SETTING THE CURRENT LIMIT (O.C.) REQUIRES CAREFUL CONSIDERATION OF THE RATING TABLE, SECTION I, TABLE 1-3. OPERATION OF THE RMK BEYOND THE PARAMETERS GIVEN IN THE RATING TABLE MAY DAMAGE THE RMK POWER SUPPLY.

3-26 OUTPUT VOLTAGE ADJUSTMENT **(V.ADJ)**

3-27 Monitoring the RMK output voltage at the output terminal with an accurate voltmeter, (M1 in FIG. 3-6, set the "V.ADJ" control to the desired value. (Refer to FIG. 3-6).

3-28 CURRENT LIMIT ADJUSTMENT **(O.C.)** Note: See Section IV, FIG. 4-1 for location

A) Set up the test circuit shown in FIG. 3-6. Close switch S1.

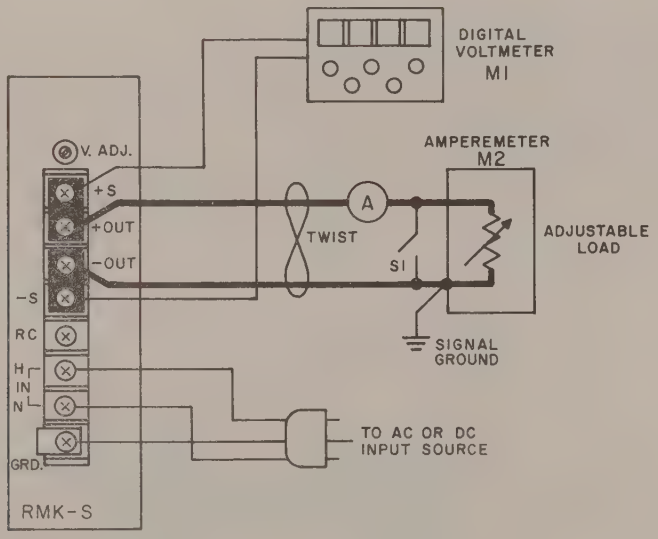


FIG. 3-6 TEST SET-UP FOR CURRENT LIMIT AND OVERVOLTAGE ADJUSTMENTS

B) Turn "O.C." Control to its maximum counterclockwise position. Turn A-C power "on". The d-c current read-out on M2 is the short-circuit current of the RMK under test. Adjust this current by turning the "O.C." control to your required load current value plus 15%. Set LOAD to its maximum resistance value and open S-1.

C) Check the current limit point by adjusting the load from its maximum resistance (minimum current) toward a value yielding the required operating current. Decrease the load resistance further monitoring M1 and M2. The output voltage should start to decrease at the adjusted current limit point, approximately 15% beyond the desired operating current.

SECTION IV – ELECTRICAL PARTS LIST AND DIAGRAMS

4-1 GENERAL

4-2 This section contains the main schematic, the parts location diagrams, and a list of all replaceable electrical parts. All components are listed in alpha-numerical order of their reference designations. Consult your Kepco Representative for replacement of parts not listed here.

4-3 ORDERING INFORMATION

4-4 To order a replacement part or to inquire about parts not listed in the parts list, address order or inquiry either to your authorized Kepco Sales Representative or to:

KEPCO, INC.
131–38 Sanford Avenue
Flushing, N.Y. 11352

4-5 Specify the following information for each part:

a) Model and complete serial number of instrument.
b) Kepco part number.
c) Circuit reference designator.
d) Description.

4-6 To order a part not listed in the parts list, give a complete description and include its function and location.

ABBREVIATIONS USED IN KEPCO PARTS LISTS

A) Reference Designators:

A	= Assembly
B	= Blower (Fan)
C	= Capacitor
CB	= Circuit Breaker
CR	= Diode
DS	= Device, Signaling (Lamp)
F	= Fuse
FX	= Fuse Holder
IC	= Integrated Circuit
J	= Jack
K	= Relay
L	= Inductor
LC	= Light-Coupled Device
M	= Meter
P	= Plug
Q	= Transistor
R	= Resistor
S	= Switch
T	= Transformer
TB	= Terminal Block
V	= Vacuum Tube
X	= Socket

B) Description Abbreviations

A	= Ampere
AC	= Alternating Current
AMP	= Amplifier
AX	= Axial
CAP.	= Capacitor
CER	= Ceramic
CT	= Center-Tap
°C	= Degree Centigrade
FXD	= Fixed
Ge	= Germanium
H	= Henry
Hz	= Hertz
IC	= Integrated Circuit
K	= Kilo (10^3)
m	= Milli (10^{-3})
M	= Mega
MFR	= Manufacturer
MET.	= Metal
n	= Nano (10^{-9})
NC	= Normally Closed
NO	= Normally Open
P	= Pico (10^{-12})
PC	= Printed Circuit
POT	= Potentiometer
PIV	= Peak Inverse Voltage
p-p	= Peak to Peak
ppm	= Parts Per Million
PWR	= Power
DC	= Direct Current
DPDT	= Double Pole, Double Throw
DPST	= Double Pole, Single Throw
ELECT	= Electrolytic
F	= Farad
FILM	= Polyester Film
FLAM	= Flammable
°F	= Degree Farenheit
RAD	= Radial
RECT	= Rectifier
REG	= Regulated
RECY	= Recovery
RES	= Resistor
RMS	= Root Mean Square
Si	= Silicone
S-End	= Single Ended
SPDT	= Single Pole, Double Throw
SPST	= Single Pole, Single Throw
TAN	= Tantalum
TSTR	= Transistor
u	= Micro (u) (10^{-6})
VAR	= Variable
V	= Volt
W	= Watt
W.W.	= Wire Wound

RMK–S GROUP **COMMON PARTS LIST** **Code 12-3179**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C1,2	2	Cap., Film, Radial Leads 0.01uF, 10%, 600V	Matsushita ECQ-F6103KZ	517-0166	1
C3	1	Cap., Elect., Axial Leads 220uF, +50 -10%, 200V	Nippon Chemi-Con SL200T-220	517-0137	1
C4,23	2	Cap., Ceramic Disc 0.047uF, +30 -80%, 50V	TDK SC45F1H473Z	517-0107	1
C5,8,9	3	Cap., Film, Radial Leads 2200pF, 10%, 50V	Matsushita ECQ-M05222KZ	517-0032	1
C7,13,14, 15,24,34	6	Cap., Elect., S-End Leads 33uF, 20%, 16V	Nippon Chemi-Con KX16VB-33	517-0123	2
C10	1	Cap., Ceramic Disc 5pF, ±0.5pF, 50V	TDK CC45SL1H050DY	517-0139	1
C11	1	Cap., Ceramic Disc 30pF, 10%, 50V	TDK CC45SL1H300KY	517-0138	1
C12	1	Cap., Elect., S-End Leads 47uF, 20%, 35V	Nippon Chemi-Con KX35VB-47	517-0134	1
C26,27, 28,29	4	Cap., Met. Film, Ax. Leads 0.047uF, 10%, 630V	NTK MDI-2J473M	517-0055	1
C30,31	2	Cap., Ceramic Disc 0.1uF, +80 -20%, 50V	TDK SC45F1H104Z	517-0121	1
C35	1	Cap., Film, Radial Leads 1000pF, 10%, 600V	Matsushita ECQ-M6102KZ	517-0058	1
CR1	1	Rectifier, Bridge 400V (PIV), 2A	Shindengen S2VB40	524-0025	1
CR2	1	Diode, Zener, Ax. Leads 75V, 5%, 0.5W	NEC RD75EB	521-0077	1
CR3,4,10,11, 14,15,18,19, 27,28,29	11	Diode, Switching, Ax. Leads 50V, (PIV), 0.2A, 0.5W	NEC 1S954	524-0008	1
CR5,13,17	3	Diode, Zener, Ax. Leads 5.6V, 3%, 0.5W	NEC RD5.6E ± 3%	521-0004	1
CR6,8,20	3	Diode, Fast Recovery, Ax. Lds. 400V (PIV), 1A	NEC 1S2674	524-0013	1
CR7	1	Diode, Zener, Ax. Leads 100V, 5%, 0.5W	NEC RD100EB	521-0076	1
CR12	1	Diode, Zener, Ax. Leads 30V, 3%, 0.5W	NEC RD30E ± 3%	521-0022	1
CR21	1	Diode, Zener, Ax. Leads 7.5V, 3%, 0.5W	NEC RD7.5E ± 3%	521-0020	1
CR24	1	Diode, Cont. Aval. Ax. Leads 250–350V_Z, 3W @ 10 μsec.	Fujidenki ERA-01-02	521-0046	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

RMK–S GROUP **COMMON PARTS LIST** **Code 12-3179**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
CR26	1	Thyristor, SCR, Flat-Pack 200V, 2A, 5W	NEC 5P2M	524-0017	1
F1	1	Fuse, Medium Acting 3A, 250V	San-O Type TSC-3A	541-0028	5
IC1	1	IC, Timer (555 Type) 8 Pin Dip	Signetics NE555N-S	550-0001	1
IC2	1	IC, Op. Amplifier 8 Pin Dip	NEC uPC 157C	550-0013	1
L1	1	Choke, Input Filter	TDK LF024UL	500-0332	1
Q1,2	2	TSTR, Si, NPN Med. Power, Flat-Pack	Sanken 2SC2023	519-0009	1
Q3	1	TSTR, Si, NPN Low Power, TO-92	Matsushita 2SC1384R	519-0024	1
Q4,5,6,7,8,9, 10,12,13,14	10	TSTR, Si, NPN Low Power, TO-92	Toshiba 2SC735	519-0008	2
Q11	1	TSTR, Si, PNP Low Power, TO-92	Toshiba 2SA562	519-0006	1
R1	1	Res., Fxd, Non-Flame., W.W. 15 ohm, 5%, 5W	Matsushita ERF-5AJ150	515-0257	2
R2	1	Res., Fxd, Carbon Film, F. P. 68k ohm, 5%, 0.25W	KOA RDF25S683J	515-0334	1
R3	1	Res., Fxd, Carbon Film, F. P. 6.8 ohm, 5%, 0.25W	KOA RDF25S6R8J	515-0381	1
R4,13,14,23, 24,31,32,46	8	Res., Fxd, Carbon Film, F. P. 4.7k ohm, 5%, 0.25W	KOA RDF25S472J	515-0328	2
R5,30,34	3	Res., Fxd, Carbon Film, F. P. 2.2k ohm, 5%, 0.25W	KOA RDF25S222J	515-0316	1
R6,19,29, 33,36,40,44	7	Res., Fxd, Carbon Film, F. P. 1k ohm, 5%, 0.25W	KOA RDF25S102J	515-0322	2
R7	1	Res., Fxd, Metal Oxide, F. P. 22k ohm, 5%, 2W	KOA RSF2B223	515-0287	1
R8	1	Res., Fxd, Carbon Film, F. P. 120 ohm, 5%, 0.25W	KOA RDF25S121J	515-0343	1
R9	1	Res., Fxd, Carbon Film, F. P. 12 ohm, 5%, 0.5W	KOA RDF50S120J	515-0392	1
R10,35	2	Res., Fxd, Carbon Film, F. P. 680 ohm, 5%, 0.25W	KOA RDF25S681J	515-0319	1
R11	1	Res., Fxd, Carbon Film, F. P. 100 ohm, 5%, 0.5W	KOA RDF25S101J	515-0351	1
R12	1	Res., Fxd, Carbon Film 220 ohm, 5%, 0.25W	Matsushita ERD-25TJ221	515-0051	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

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RMK–S GROUP **COMMON PARTS LIST** **Code 12-3179**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
R15,20,21	3	Res., Fxd, Carbon Film 330 ohm, 5%, 0.25W	Matsushita ERD-25TJ331	515-0093	1
R16,25	2	Res., Fxd, Carbon Film 10k ohm, 5%, 0.25W	Matsushita ERD-25TJ103	515-0055	1
R18	1	Res., Fxd, Carbon Film 100 ohm, 5%, 0.25W	Matsushita ERD-25TJ101	515-0064	1
R22	1	Res., Fxd, Carbon Film 2.7k ohm, 5%, 0.25W	Matsushita ERD-25TJ272	515-0088	1
R26	1	Res., Fxd, Carbon Film 12k ohm, 5%, 0.25W	Matsushita ERD-25TJ123	515-0054	1
R27	1	Res., Fxd, Carbon Film 560 ohm, 5%, 0.25W	Matsushita ERD-25JT561	515-0052	1
R37	1	Res., Fxd, Carbon Film 1.8k ohm, 5%, 0.25W	Matsushita ERD-25TJ182	515-0094	1
R38,53	2	Res., Fxd, Carbon Film 22k ohm, 5%, 0.25W	Matsushita ERD-25TJ223	515-0169	1
R39	1	Res., Fxd, Carbon Film 5.6k ohm, 5%, 0.25W	Matsushita ERD-25TJ562	515-0148	1
R42	1	Res., Fxd, Carbon Film 82 ohm, 5%, 0.25W	Matsushita ERD-25TJ820	515-0057	1
R45	1	Res., Fxd, Carbon Film 39 ohm, 5%, 0.5W	Matsushita ERD-50TJ390	515-0297	1
R47	1	Res., Fxd, Carbon Film 68 ohm, 5%, 0.5W	Matsushita ERD-50TJ680	515-0011	1
R50	1	Res., Var. Trim 2k ohm, 20%, 0.5W	Copal Electronics RJ6X-2k ohm	515-0115	1
R51	1	Res., Var. Trim 1k ohm, 20%, 0.5W	Copal Electronics RJ6P-1k ohm	515-0219	1
R52	1	Res., Fxd, Metal Oxide, F. P. 0.33 ohm, 5%, 2W	KOA RSF-2BR33J	515-0282	1
R54	1	Res., Fxd, Carbon Film 33k ohm, 5%, 0.25W	Matsushita ERD-25TJ333	515-0146	1
T1	1	Transformer, Auxiliary	TDK DT063UL	500-0333	1
T3	1	Transformer, Driver	TDK PT027UL	500-0334	1
T4	1	Transformer, Current Sensing	TDK CT008UL	500-0247	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

KEPCO® REPLACEMENT PARTS LIST

RMK 24–S **INDIVIDUAL PARTS LIST** **Code 12-3179**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C6	1	Cap., Film, Rad. Leads 2200pF, 10%, 400V	Matsushita ECQ-M4222KZ	517-0100	1
C16,17, 18,19,20	5	Cap., Elect., S-End Leads 100uF, 20%, 50V	Nippon Chemi-Con KX50VB-100	517-0136	1
C22	1	Cap., Film, Rad. Leads 1000pF, 10%, 400V	Matsushita ECQ-M4102KZ	517-0036	1
CR16	1	Diode, Zener, Ax. Leads 27V, 3%, 0.5W	NEC RD27E ± 3%	521-0046	1
CR22	1	Diode, Fast Recovery, C.T. 300V (PIV), 8A	Sanken 10C2S31	524-0037	1
L2	1	Choke, Output Filter	TDK CH056UL	500-0343	1
R28	1	Res., Fxd, Carbon Film 47 ohm, 5%, 0.25W	Matsushita ERD-25TJ470	515-0086	1
R41	1	Res., Fxd, Carbon Film 12k ohm, 5%, 0.25W	Matsushita ERD-25TJ123	515-0054	1
R43	1	Res., Fxd, Carbon Film 22k ohm, 5%, 0.25W	Matsushita ERD-25TJ223	515-0169	1
T2	1	Transformer, Power	TDK MT112UL	500-0344	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

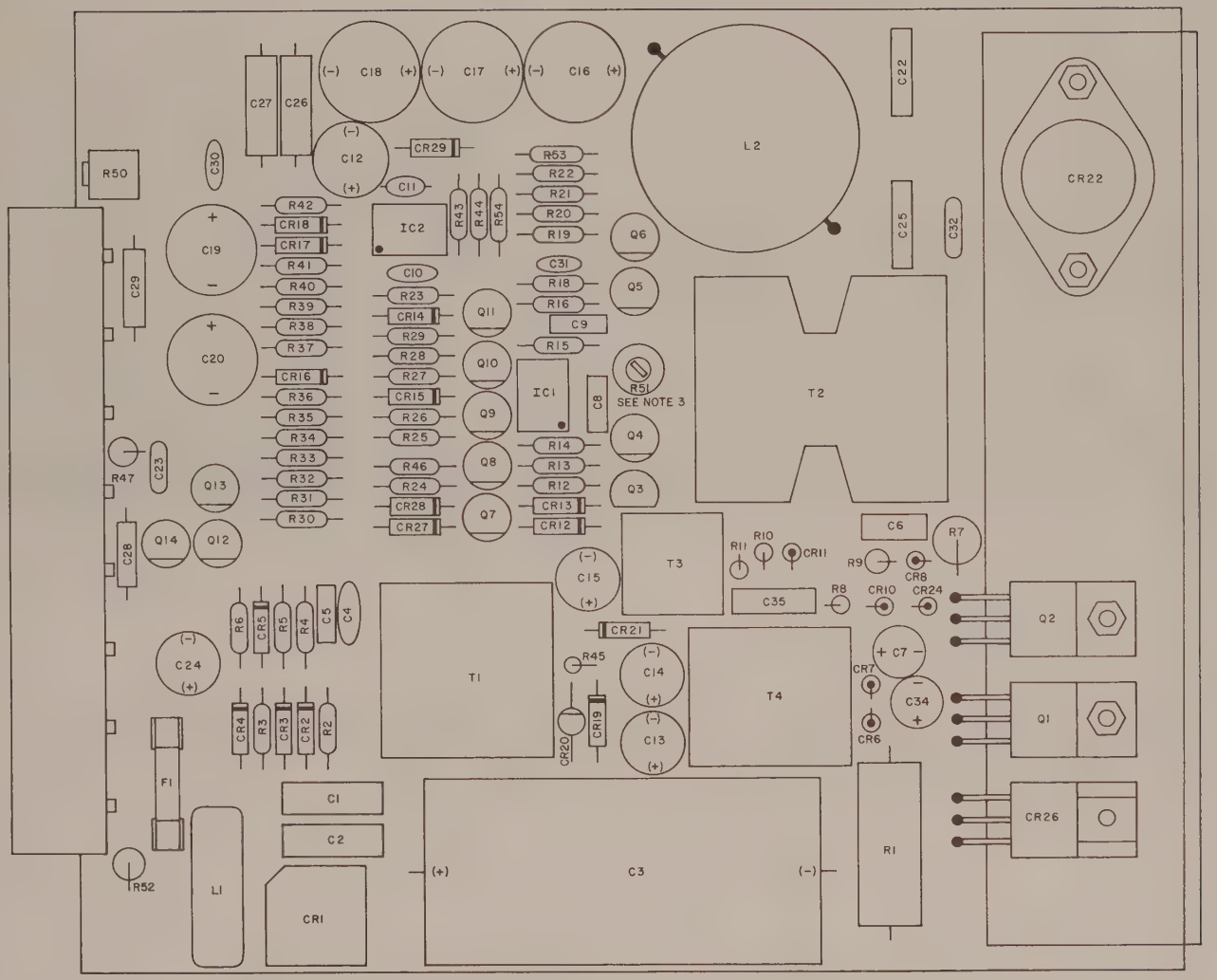
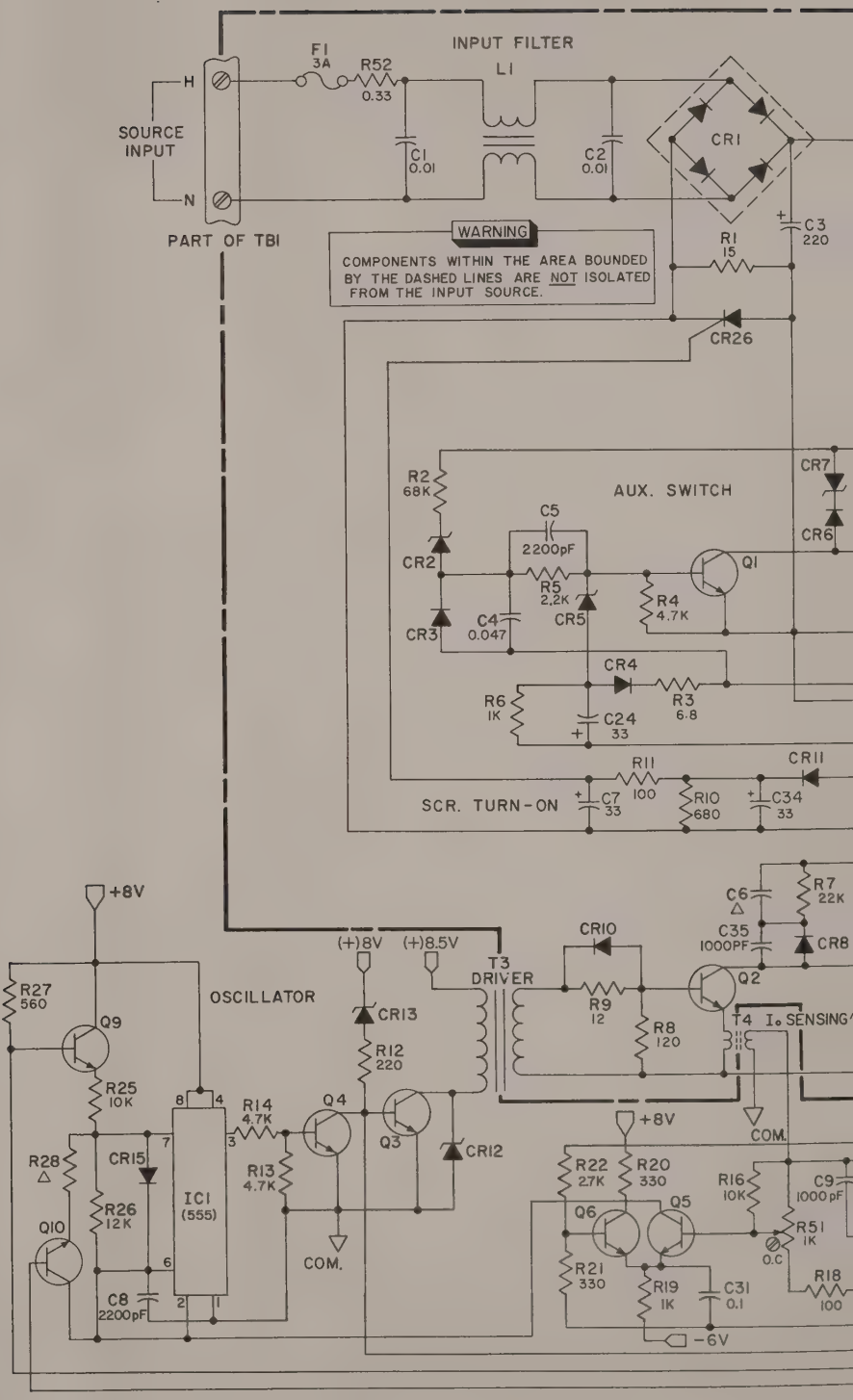


FIG. 4-1 COMPONENT LOCATION DRAWING, RMK-S SERIES.

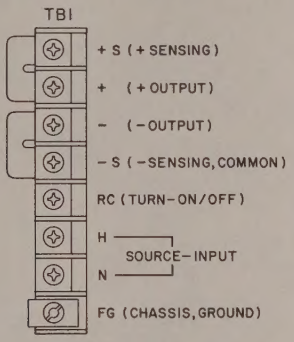
NOTES:
1. NOT ALL COMPONENTS USED ON ALL MODELS, SEE PARTS LIST.
2. DIODES MARKED "⏚" ARE MOUNTED WITH CATHODE UP.
3. CURRENT LIMIT ADJUSTMENT, R51 ("OC").



kepco
Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. ® will be supplied on request.

NOTES:

1- RESISTOR VALUES IN OHMS, K=10^3
2- CAPACITOR VALUES IN MICROFARADS (K=10^3), EXCEPT AS NOTED.
3- VOLTAGE READINGS ARE NOMINAL AND TAKEN WITH A 20 KΩ/VOLT VOLTMETER, WITH REFERENCE TO COMMON AT 115 Va-c INPUT, NO LOAD.
4- BARRIER-STRIP TERMINAL CONNECTIONS:



5- FOR VALUES OF COMPONENTS MARKED "Δ" SEE PARTS LIST. NOT USED IN ALL MODELS. SEE PARTS LIST FOR VALUE.

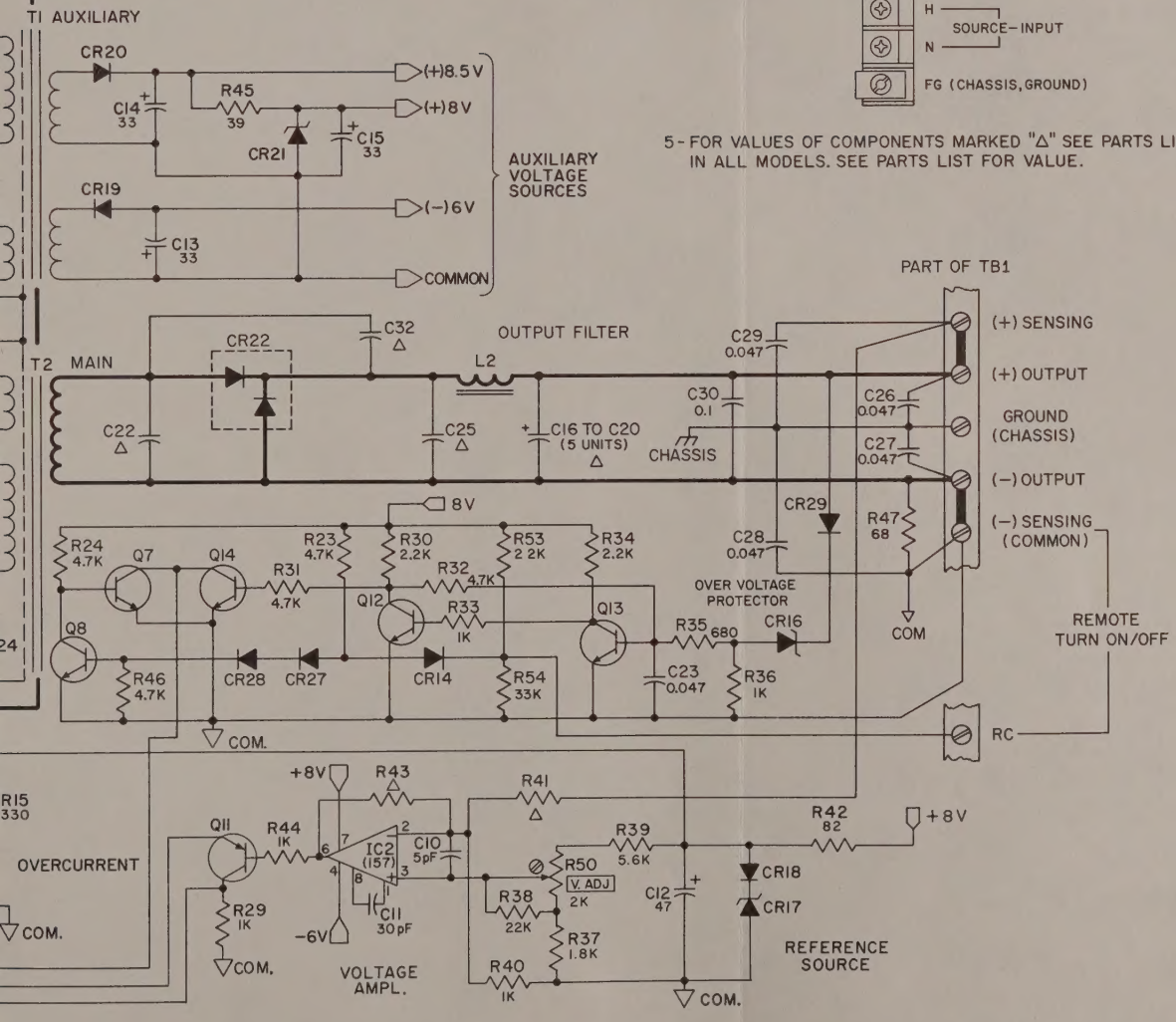


FIG. 4-2 SCHEMATIC DIAGRAM, RMK-S SERIES.

Kepco 5 Year Warranty

This is to certify that we, KEPCO, INC. (hereinafter called "Company"), Flushing, N. Y. 11352 U.S.A., warrants, for a period of FIVE YEARS, this instrument known as:

MODEL: _____

SERIAL: _____

The Company's products are warranted for a period of five years from date of delivery to be free from defects in materials and workmanship and to conform to the specifications furnished or approved by the Company. Liability under this warranty shall be limited to the repair or replacement of any defective product at Company's option.

If any defect within this warranty appears within the warranty period, the Purchaser shall promptly notify the Company in writing. No material will be accepted for repair or replacement without written authorization of the Company. Upon such authorization, and in accordance with instructions of the Company, parts or materials for which replacement is requested shall be returned to the Company for examination, with shipping charges prepaid by the Purchaser. Final determination as to whether a product is actually defective rests with the Company.

This warranty does not extend to any product which has been subjected to misuse, neglect, accident, improper installation, or to use in violation of instructions furnished by the Company. The warranty does not extend to, or apply to, any unit which has been repaired or altered outside of the Company's factory by persons not expressly approved by the Company.

THE WARRANTY HEREIN CONTAINED IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY.

KEPCO EQUIPMENT IS WARRANTED FOR FIVE YEARS!

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N. Y. 11352 U.S.A. • (212) 461-7000

Detach and RETURN this Card

Gentlemen:

Please register my name to insure my warranty on:-

MODEL NO.: _____

SERIAL NO.: _____

DATE RECEIVED: _____, 19___

COMPANY NAME: _____

STREET: _____

CITY: _____

STATE: _____ ZIP: _____

Registered by: _____ Dept.: _____

Please send me: ☐ Complete Power Supply Catalog.

☐ Data on _____

_____

☐ Have Kepco Sales Engineer Call.

Please PRINT

1. What influenced your choice of this Power Supply?

☐ Previous experience (what models do you have)?

_____

_____

_____

☐ Magazines, which do you recall? _____

_____

☐ Trade Show, which one? _____

☐ Directory: _____

☐ Kepco's Catalog or Brochure _____

☐ Sales Representative _____

_____

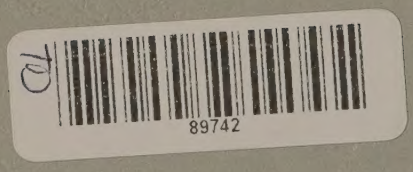
☐ Other _____

2. What products would you like to see Kepco make?

_____

_____

_____



KEPCO®

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